

## PATENT SPECIFICATION

DRAWINGS ATTACHED

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## COMPLETE SPECIFICATION

## Materials Mixing Process and Apparatus

- I, HANS JOACHIM ZIMMER, trading as HANS J. ZIMMER VERFAHRENSTECHNIK, of 1—7, Borsigallee, Frankfurt/Main, Germany, a German national, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—
- The present invention concerns the mixing of liquids, either with other liquids or with pulverulent solids.
- For mixing liquids having a different viscosity in a continuous operation it has already been known for the liquids to be mixed to be conducted through a pipe and a certain turbulence produced in this stream by means of rotating vanes or the like. It is also known for mixing liquids of different viscosity by means of the continuous method to use a rotating element having a screw conveyor on which in addition an opposing worm is mounted. This apparatus also to a limited extent permits the turbulence to be utilized for mixing.
- When processing plastics materials, more especially polymerised plastics materials which in the liquid state have a high viscosity, e.g. between 500 and 5000 poise, difficulties are encountered during mixing which cannot be controlled either by means of conventional methods or by the apparatus used for carrying out such methods. This becomes evident in particular when pulverised solids are admixed to the liquid plastics compound and are to be evenly distributed therein. In known continuous mixing methods it is impossible to prevent the formation of small lumps.
- An object of the present invention is to provide a mixture which is as nearly perfect as possible, e.g. of two liquids of different viscosity or of a liquid and a pulverulent solid substance.
- According to the present invention the components to be mixed are conducted in known manner in a continuous stream but due to the action of flat or substantially flat surfaces adapted to rotate in a substantially cylindrical housing the components are subjected to a high pressure in that they are forced through small gaps between the chambers which are formed by the rotating and fixed elements. This causes a considerable turbulence whereby the components to be mixed are mixed together in a narrow space by forming very small eddy movements which however are very effective. This is caused by the spaces between the rotating surfaces and the substantially cylindrical wall in combination with the narrow gaps.
- As apparatus for carrying out the new method it is possible to use a revolving shaft provided with flats which is accommodated in a cylindrical housing and which constitutes a feed screw and possibly also a discharge screw.
- The revolving shaft may have a triangular or pentagonal cross-section.
- The width of gap is to be selected in consideration of the material to be processed.
- If it is intended to use the new method for distribution of pulverulent solids in the viscous compound, e.g. in a polymerised plastics material, it is possible for the powder, e.g. a dye powder to be reduced to a paste either by heating or by previously mixing it with a small quantity of the plastics material. It is possible however in accordance with the new method for the powder to be admixed without any special preparations since all lumps and knot formations are eliminated due to the new method of treatment, thus obtaining a perfectly homogeneous mixture.
- It is possible either for two or more liquids of different viscosity to be mixed and/or pulverulent solids to be distributed in a viscous liquid, possibly even in two different highly viscous liquids the mixing of which is effected with the distribution of solids.
- The invention will be described further,

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by way of example, with reference to the accompanying drawings, in which:—

Fig. 1 is a longitudinal section showing a preferred form of apparatus for carrying out the method of the invention; and Figs. 2 and 3 are each a composite detail partly in longitudinal elevation and partly in cross section.

A mixing apparatus (Fig. 1) includes a housing having inlet and outlet connections 11a, 11b respectively and a shaft 12 mounted for rotation within the housing 11, the material to be mixed being caused to move axially of the shaft in a continuous stream.

The shaft 12 may be provided with five flats, i.e. may have a pentagonal cross section in its central region (Fig. 2) or it may be triangular (Fig. 3).

Fig. 3 shows a shaft 12 provided with oppositely threaded screw conveyor sections 12a and 12b near its ends, adapted in operation to effect a compression of the materials being mixed by tending to feed them towards a mid-region along the casing.

WHAT I CLAIM IS:—

1. A method for mixing liquids of high viscosity with other liquids and/or pulverulent solids in a continuous operation, in which the materials are subjected to a high pressure in a cylindrical housing which pressure is caused by rotating flat or substantially flat surfaces whereby the material passes through a number of narrow gaps into spaces formed

by the rotating flats, which spaces are in communication by way of said gaps, said materials also being caused to move longitudinally of said surfaces.

2. A method as claimed in Claim 1, in which a liquid of high viscosity has a pulverulent solid substance mixed therewith or distributed therein, characterised by said solid having previously been reduced to a paste by heating or mixing with a liquid of high viscosity.

3. A method of mixing materials substantially as described herein with reference to the accompanying drawings.

4. An apparatus for mixing materials comprising a longitudinally extending casing having inlet and outlet connections respectively disposed near its opposite ends and a shaft having a plurality of flats thereon and adapted to rotate with a small clearance within the casing.

5. An apparatus as claimed in Claim 4, in which the shaft includes oppositely threaded screw conveyor sections near its ends for compressing the materials being mixed towards a mid-region along the casing.

6. An apparatus for mixing materials, constructed and arranged to operate substantially as herein described with reference to and as illustrated in the accompanying drawings.

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## COMPLETE SPECIFICATION

1 SHEET

*This drawing is a reproduction of  
the Original on a reduced scale*